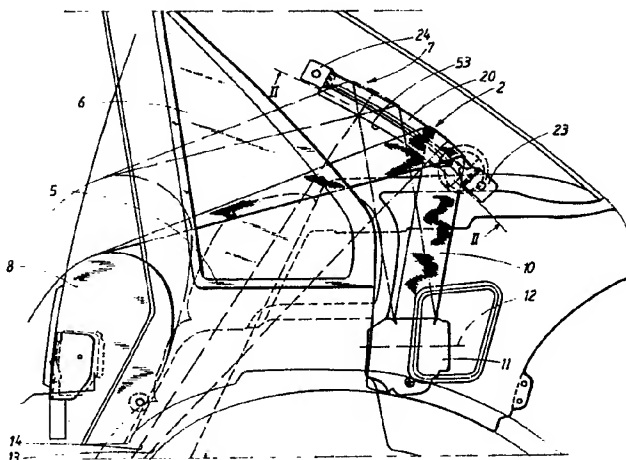




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B60R 22/20	A1	(11) International Publication Number: WO 92/10385 (43) International Publication Date: 25 June 1992 (25.06.92)
(21) International Application Number: PCT/SE91/00844 (22) International Filing Date: 5 December 1991 (05.12.91) (30) Priority data: 9003883-7 6 December 1990 (06.12.90) SE (71) Applicant (for all designated States except US): AB VOLVO [SE/SE]; S-405 08 Göteborg (SE). (72) Inventor; and (75) Inventor/Applicant (for US only) : PILHALL, Stig [SE/SE]; Skillnadsgatan 46, S-461 53 (SE). (74) Agents: GRAUDUMS, Valdis et al.; Albihn West AB, Box 142, S-401 22 Göteborg (SE).		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>
(54) Title: HEIGHT-ADJUSTABLE SEATBELT (57) Abstract <p>Height-adjustment arrangement for safety belts in vehicles, primarily for safety belts intended for rear seat passengers. The safety belt (10) is of the retractable, reel-type and the reel (11) is affixed to the vehicle body (3). The height-adjustment arrangement (2) comprises a longitudinally extending guide member (2) mounted to the body at a passenger's shoulder-height, the length of which guide member considerably exceeds the width of said safety belt. The member (2) presents a guide surface (20) continuously curved in the longitudinal extension and intended for guiding and adjusting the height of the safety belt. The invention is characterized by the combination that the guide surface (20) is positively curved for the majority of its length along its longitudinal extension so that a convex surface is formed along its length, that the guide member has a substantially longitudinal extension which forms an acute angle with respect to the horizontal plane, which angle preferably is equal to, or less than, 45° ($\alpha \leq 45^\circ$) and that said reel (11) is mounted substantially horizontally.</p>		



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⁺ Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

5 **TITLE:** Height-adjustable seatbelt.

TECHNICAL FIELD:

10 The present invention relates to a height-adjustment arrangement for safety belts in vehicles, primarily for safety belts intended for rear seat passengers, whereby the safety belt is of the retractable, reel-type and the reel is affixed to the vehicle body, said height-adjustment arrangement comprising a longitudinally extending guide member mounted to the body at a passenger's shoulder-
15 height, the length of which guide member considerably exceeds the width of said safety belt and which member at least partially presents a guide surface continuously curved in the longitudinal extension and intended for contact with a portion of the safety belt which is between
20 said reel and the length intended to extend over the shoulder and chest, and which portion runs directly from the reel to said guide member which simultaneously permits height-adjustment of the belt on the guide member.

25 **BACKGROUND OF THE INVENTION:**

Height-adjustment arrangements of the above-mentioned type are previously known. A height-adjustment arrangement is known from i.a. DE-A-3 815 629 for safety belts in vehicles, primarily for safety belts intended for rear seat
30 passengers, whereby the safety belt is of the retractable, reel-type and the reel is affixed to the body, said height-adjustment arrangement comprising a longitudinally extending guide member mounted to the body at a passenger's shoulder-height, the length of which guide member
35 considerably exceeds the width of said safety belt and which member in a transverse section at least partially

presents a continuously curved outer surface intended for contact between a portion of the safety belt which is between said reel and the length of the safety belt which is intended to extend over the shoulder and chest (see also DE-A-3 815 631).

The previously known height-adjustment arrangements suffer from the disadvantage that the height-adjustment arrangement must be complemented with a guide member which is located a certain distance from the actual height-adjustment arrangement, which in turn requires a very wide D-post. A wide D-post brings with it i.a. the drawback that it eliminates or at least complicates the fitting of a small side window.

An arrangement is known from DE-A1-3 530 495 which has a common member for height-adjustment and guiding. This arrangement is particularly intended for front seats and has a belt geometry which does not offer satisfactory self-adjustment of the height position.

The object of the present invention is primarily to provide a belt for rear seat use with which high-grade self-adjustment of the height position of the upper mounting point is achieved.

SOLUTION:

Said object is achieved with an arrangement which is characterized by the combination that said guide surface is positively curved for the majority of its length along its longitudinal extension so that a convex surface is formed along its length, that the guide member has a substantially longitudinal extension which forms an acute angle with respect to the horizontal plane, which angle preferably is equal to, or less than, 45° ($\alpha \leq 45^\circ$) and that said reel is mounted substantially horizontally.

Further advantages and objects of the invention will become apparent from the claims and following description.

BRIEF DESCRIPTION OF THE DRAWINGS:

5 The invention will be described in greater detail in the following with reference to the attached drawings in which;

Fig. 1 shows a partial section through a vehicle in which a preferred arrangement according to the invention is mounted,

Fig. 2 shows a longitudinal cross-section of a member according to the invention shown in Fig. 1,

Fig. 3 shows a transverse cross-section through the member of Fig. 2,

15 Fig. 4 shows an alternative embodiment of a member according to the invention, and

Fig. 5 shows a further modified embodiment of a member according to the invention.

20 BEST MODE OF CARRYING OUT THE INVENTION:

Fig. 1 shows a part of a vehicle comprising the upper region of the rear seat back-rest 5, a small side window 6 and a D-post 7. A guide member 2 is affixed to the inside of the D-post 7. A safety belt 10 runs over the guide member 2. The safety belt extends from a belt reel 11 which is mounted to the body 3 by screw means 4. The belt reel 11 is mounted substantially horizontally which implies that the centre axis 12 of the reel extends horizontally. The safety belt 10 runs from the guide member 2 over the rear seat back-rest 5 to the shoulder 8 of an imaginary passenger. The guide member 2, which also acts at the same time as a height-adjuster, consists of a longitudinally extending circular rod having an outer surface 20 which is circularly curved in cross section and which has a slight positive longitudinal curvature. The rod 2 is attached to the D-post at its respective ends 23, 24 by screw means or

similar.

5 In the situation depicted by solid lines the safety belt has been adjusted for the shoulder position of a relatively short person (5% female). The belt 10 hereby runs as far down towards the lower end of the mounting 23 as possible. In the situation shown in dashed lines the safety belt 10 has been adapted to a relatively tall person (95% male) and the belt is here in its upper position and thus as close to the upper mounting point 24 as possible.

15 In order to attain such self-adjustment, the guide member should be shaped in a certain way. In the preferred instance, this means that, as mentioned previously, said outer surface 20 is also curved along its longitudinal extension and that the curvature is positive so that a convex surface is formed. Said curvature in the longitudinal direction in this preferred case follows the arc of a circle with a radius of curvature of circa 600 mm.

20 This radius of curvature is pre-calculated to be the distance between said surface and the point of intersection of two lines 13,14, whereby each of said lines corresponds to the normal to said outer surface 20 at respective extreme positions of the safety belt 10 on the guide member 2. These lines 13,14 extend from the guide point for the safety belt 10. The result of the guiding of the belt 10 is determined by the optical laws of reflection, i.e. in each height position the angle of approach that the belt makes to the rod's normal is equal to the angle to the normal

30 which the belt forms when leaving the rod. A limiting factor has been that the length of the safety belt 10 which is between the reel 11 and the guide member 2 may not be allowed to "swing" too much in order to avoid any possible malfunction, i.e. the angle between the direction of

35 emergence of the safety belt 10, seen from the reel 11, in the two extreme positions may not exceed a certain given

angle. In the preferred case, this angle has been set at 20°. Accordingly, the upper bisectrix 14 represents a mid-line shown in the plane of the paper in Fig. 1 between (as seen from the guide point) incoming and exiting regions of the safety belt 10 when the belt is in an upper extreme position, i.e. for a very tall person (95% male), and the lower bisectrix 13 represents a mid-line shown in the plane of the paper in Fig. 1 between (as seen from the guide point) incoming and exiting regions of the safety belt 10 when the belt is in a lower extreme position, i.e. for a very short person (5% female).

In order to achieve good height adjustment in accordance with the invention, in the shown example the guide member 2 is mounted so as to create a relatively sharp acute angle with respect to the horizontal line. In the preferred illustrated case this angle is circa 40° for a line which is drawn between the two mounting points 23, 24. It is advantageous if the distance between the guide member 2 and the belt reel 11 is relatively large, in the preferred case 200 mm from the centre of the reel to the lower region of the guide surface 20. Accordingly, it is advantageous if the reel is mounted as low as possible above the wheel-arch so that the sideways movement of the belt, in accordance with the above, will not be too great. Such a sideways movement in the preferred shown example may amount to +-10°, though no more than 30° max. An advantage of mounting the reel axis horizontally is that no adaptation for left and right side fitting is required.

In the shown preferred example the active surface 20 of the rod 2 is positively curved, which means that a larger range is obtained than if the rod were straight or even had a negatively curved surface 20. A condition for the invention to work is that the friction between the belt and the outer surface 20 of the rod 2 is not too great. A fairly well

polished steel surface has been shown to work well.

5 A longitudinal view of the invention is shown in Fig. 2 in which the rod 2 consists of a hollow tube which is flattened at its ends 23 at which it is affixed to sheet sections 7 of the D-post by screw means 4. In order to maintain a desired gap width (optimum circa 2-2.5 mm, preferably 1.5-2.5 mm) in the gap 26 between the guide member 2 and the locating section 7, spacers 9 of a thickness corresponding to the gap width are used, provided that the under surface of the guide member is straight. A transverse cross-section is shown in Fig. 3 and also illustrates the tubular form of the guide member 2. As can additionally be seen from this latter figure, the active surface 20 of the member 2 is less than a semi-circle since it consists only of that region in which contact can arise between the safety belt 10 and the outer surface 20 of the rod. A covering partition wall 5 is provided above the rod 2 through which the safety belt exits from an opening 51. To achieve a gentle transition this opening is arranged with a lower edge 55 which is slightly inwardly curved towards the centre of the rod 2. The partition wall is made from a relatively shape-stable material so that there is no risk that the rod itself will be a safety hazard for the vehicle's passengers.

25 An alternative embodiment of the rod according to the invention is shown in Fig. 4. The rod is hereby formed with a discontinuity 21 in proximity to, though above, its middle, so that an increased retention of the belt in the upper position is achieved. The discontinuity has been achieved by bending the rod 2 in two places so that a "step" is formed. A further modification is shown in Fig. 5 in which the rod 2 is provided with a positive curvature 25 close to its lower mounting point 23. This positive curvature in the lower region allows careful adjustment of

the belt if the geometry of the vehicle is such that the retracting position for the belt is relatively upright.

The invention is not restricted to that which has been shown, but can be varied within the scope of the appended claims. Accordingly it is possible that for example, instead of for a rod, a U-shaped pressed plate may be used, or some kind of preferably fibre-reinforced polymer material. Even if a preferred optimal location of the reel and guide respectively gives the guide rod a slope of around 40° - 45° , it is to be understood that the invention will also work with deviations from this angle. The distance between the reel 11 and the lower region of the outer active surface 20 can be varied within the previously given range, i.e. $\pm 30^{\circ}$ approx., though the reel should preferably be located as far from the guide member 2 as possible and at least 150 mm, preferably greater than 250 mm. The longitudinal extension of the member 2 is dependent on the angle of slope and the lower the angle, the longer the rod needs to be (provided that the reel remains stationary). In the preferred case the longitudinal extension of the active surface is circa 180-200 mm at an angle of 40° . The longitudinal extension should at least exceed 150 mm. This extension can accordingly also be varied with respect to the slope in a manner which is apparent to the skilled person. The radius of curvature for said curvature should be less than 3000 mm, preferably within the range 400 - 1000 mm and in the shown case 600 mm $\pm 10\%$.

CLAIMS:

5
1. Height-adjustment arrangement for safety belts in vehicles, primarily for safety belts intended for rear seat passengers, whereby the safety belt (10) is of the retractable, reel-type and the reel (11) is affixed to the vehicle body (3), said height-adjustment arrangement (2) comprising a longitudinally extending guide member (2) mounted to the body at a passenger's shoulder-height, the length of which guide member considerably exceeds the width of said safety belt and which member (2) at least partially presents a guide surface (20) continuously curved in the longitudinal extension and intended for contact with a portion of the safety belt which is between said reel (11) and the length intended to extend over the shoulder and chest, and which portion runs directly from the reel (11) to said guide member (2) which simultaneously permits height-adjustment of the belt on the guide member, characterized by the combination that said guide surface (20) is positively curved for the majority of its length along its longitudinal extension so that a convex surface is formed along its length, that the guide member has a substantially longitudinal extension which forms an acute angle with respect to the horizontal plane, which angle preferably is equal to, or less than, 45° ($\alpha \leq 45^\circ$) and that said reel (11) is mounted substantially horizontally.

2. Height-adjustment arrangement according to claim 1, characterized in that said longitudinal curvature substantially follows a line corresponding to a radius of curvature which is less than 3000 mm, preferably in the range 1000-400 mm and most preferably 600 mm $\pm 10\%$,

which latter radius of curvature is suitably subtended by the intersection point between two bisectrices to the seat belt angles in respective extreme positions on said outer surface (20).

5

3. Height-adjustment arrangement according to claim 1, characterized in that the distance between the central axis (12) of the reel (11) and the nearest point on said outer surface (20) at least exceeds 150 mm, though preferably exceeds 200 mm and most preferably exceeds 250 mm.

10

4. Height-adjustment arrangement according to claim 1, characterized in that said outer surface (20) has a substantially longitudinal extension which exceeds 150 mm, though preferably exceeds 200 mm.

15

5. Height-adjustment arrangement according to claim 1, characterized in that said outer surface (20) presents a discontinuity (21) along its length so that a step is formed for increased retention of the safety belt in the upper position.

20

6. Height-adjustment arrangement according to claim 1, characterized in that said outer surface (20) presents a negatively curved region in the vicinity of the lower mounting point (23) to avoid possible wear of the safety belt during its retraction.

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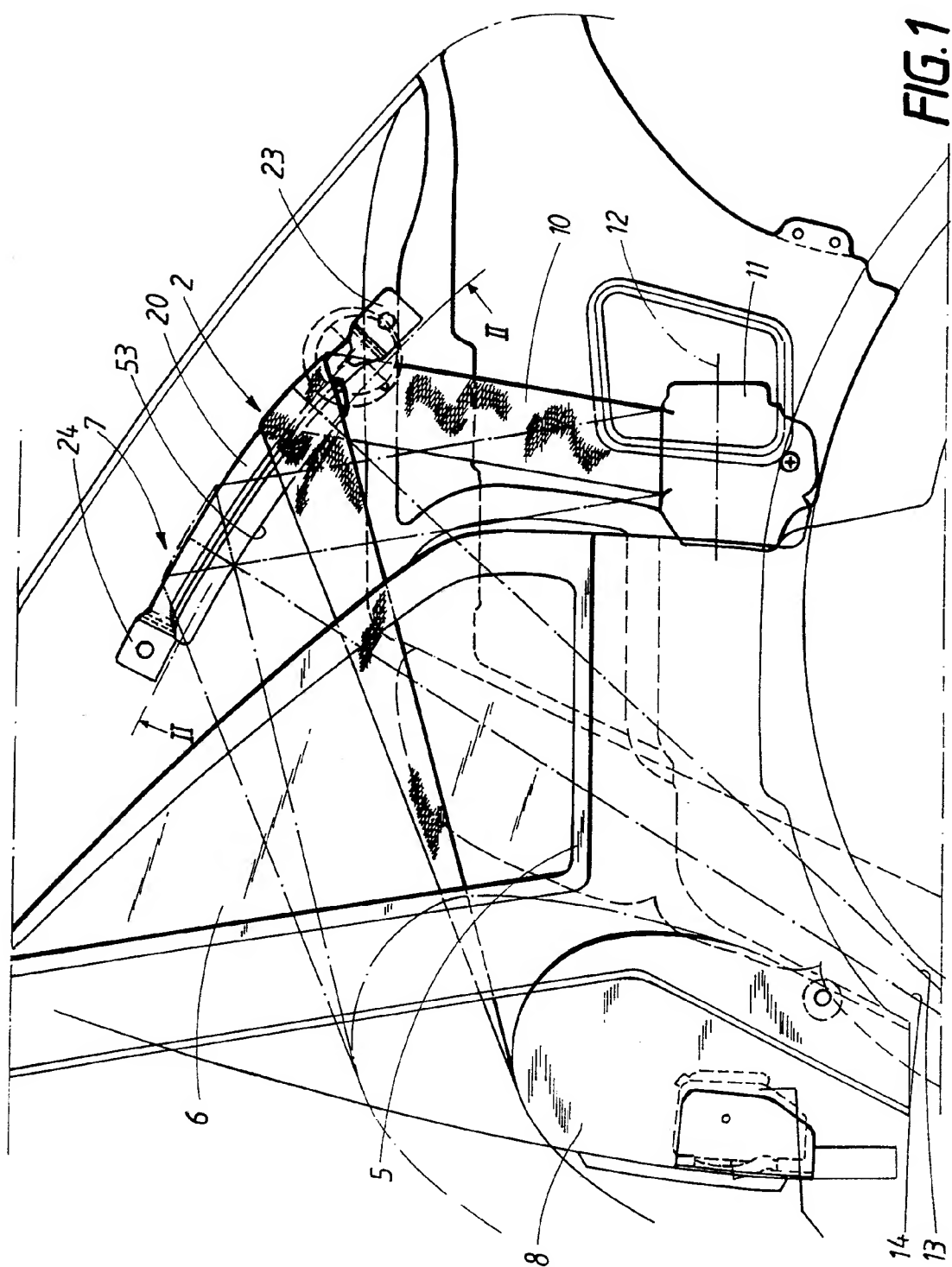
7. Height-adjustment arrangement according to claim 2, characterized in that the extension of the member (2) is such that the safety belt, as it unwinds from the reel (11), is allowed to swing a maximum of 30° between the two end positions on said member (2), though preferably 20°.

30

35

8. Height-adjustment arrangement according to claim 1, characterized in that the gap (26) between the guide (2) and the sheet section (7) is achieved by means of spacers (9) of desired thickness which give a gap width preferably between 1.5 and 2.5 mm.
- 5

1/2



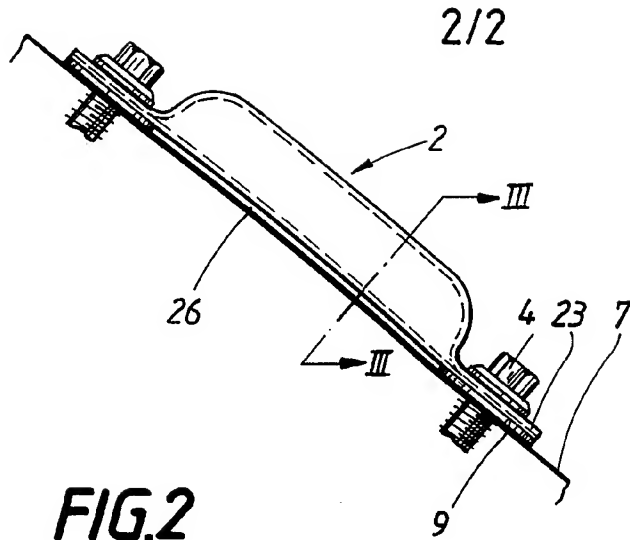


FIG. 2

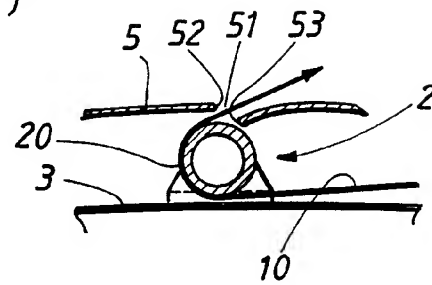


FIG. 3

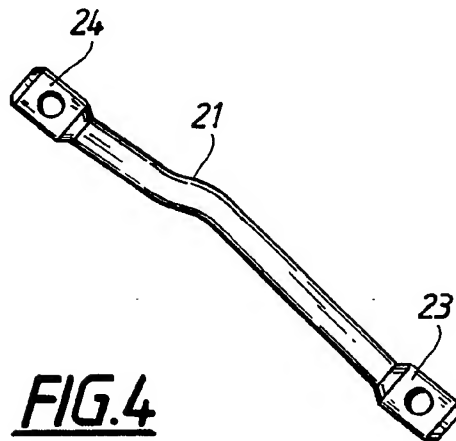


FIG. 4

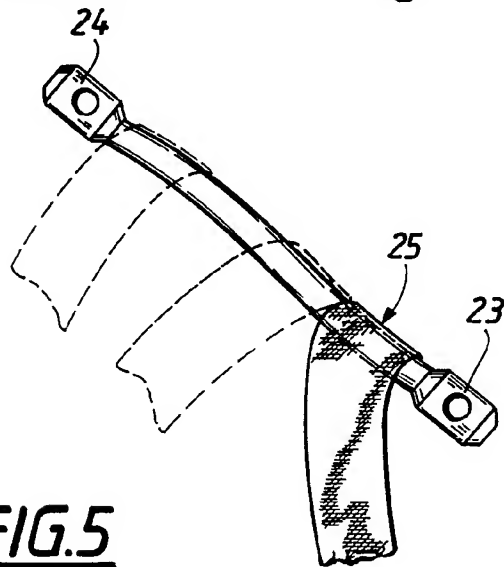


FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00844

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 60 R 22/20																										
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 5px;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none; padding: 5px;">Classification System</td> <td style="border: none; padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="border: none; padding: 5px;">IPC5</td> <td style="border: none; padding: 5px;">B 60 R</td> </tr> </table> <div style="text-align: center; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <p style="margin-top: 10px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	B 60 R																				
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IPC5	B 60 R																									
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 60%;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>DE, A1, 3530495 (DR ING. H.C. F. PORSCHE AG) 5 March 1987, see the whole document</td> <td style="text-align: center; vertical-align: top;">6</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="text-align: center;">---</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>DE, A1, 3843308 (AUTOLIV-KOLB GMBH & CO KG) 26 June 1990, see column 3, line 36 - line 66</td> <td style="text-align: center; vertical-align: top;">1-5,7-8</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td style="text-align: center;">---</td> <td style="text-align: center; vertical-align: top;">6</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>DE, A1, 3815629 (DAIMLER-BENZ AKTIENGESELLSCHAFT) 5 October 1989, see the whole document</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>DE, A1, 3815631 (DAIMLER-BENZ AKTIENGESELLSCHAFT) 16 November 1989, see the whole document</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td></td> <td style="text-align: center;">-----</td> <td></td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	DE, A1, 3530495 (DR ING. H.C. F. PORSCHE AG) 5 March 1987, see the whole document	6	A	---	1	X	DE, A1, 3843308 (AUTOLIV-KOLB GMBH & CO KG) 26 June 1990, see column 3, line 36 - line 66	1-5,7-8	Y	---	6	A	DE, A1, 3815629 (DAIMLER-BENZ AKTIENGESELLSCHAFT) 5 October 1989, see the whole document	1	A	DE, A1, 3815631 (DAIMLER-BENZ AKTIENGESELLSCHAFT) 16 November 1989, see the whole document	1		-----	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																										
IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; padding: 5px;"> Date of the Actual Completion of the International Search 3rd March 1992 </td> <td style="width: 50%; border: none; padding: 5px;"> Date of Mailing of this International Search Report 1992 -03- 1 0 </td> </tr> <tr> <td style="border: none; padding: 5px;"> International Searching Authority SWEDISH PATENT OFFICE </td> <td style="border: none; padding: 5px;"> Signature of Authorized Officer Hans Nordström </td> </tr> </table>			Date of the Actual Completion of the International Search 3rd March 1992	Date of Mailing of this International Search Report 1992 -03- 1 0	International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Hans Nordström																				
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00844**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 30/12/91
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3530495	87-03-05	EP-A-B- 0215220	87-03-25
DE-A1- 3843308	90-06-26	EP-A- 0374893	90-06-27
DE-A1- 3815629	89-10-05	NONE	
DE-A1- 3815631	89-11-16	DE-A- 3844569	89-11-16